



CLARK COUNTY BUILDING DEPARTMENT

Solar Photovoltaic Systems

Building Permit Guide



Part I. General Information

This guide is intended to ensure an electrically and structurally safe installation of solar photovoltaic (PV) systems whether interactive or stand alone. Portions of solar PV systems for buildings and structures can operate up to 600 volts under worst case scenarios depending on the direct current input parameters of the chosen inverter system(s). Also, depending on the electrical configuration of the PV modular array and the amount of modules utilized within a solar PV system, currents on each string of modules along with total system capacity can reach hundreds of amperes. Larger grid support arrays producing megawatts of power can operate at 12,470 volts and produce thousands of amperes. As such, the voltages and currents present in a solar PV system are dangerous.

PV panel mounting can occur in many different ways, the most common of which is flush attachment to a sloped roof for residential applications. Panels can be flat mounted on flat roofs or can be tilt mounted on a frame system. They can also occur on ground mount posts or frames as well as on parking shade structures and can include a tracking device to allow for rotation synchronized with the movement of the sun across the sky. Individual PV module dimensions can vary from 2- 3 feet in width by 3- 4 feet in length while panel assemblies can be much larger.

Outlined within this guide are the minimum plans submittal requirements to obtain permits for all solar PV systems that produce electricity of any voltage to buildings, whether occupiable or not, to structures including but not limited to light poles and parking covers, and to any type of equipment including but not limited to pumps, fences, cellular communications equipment and the charging of batteries. The requirements of this guide also apply to large scale PV 'farms' not located on utility company property which are intended to generate high voltage and/or high amperages that are interactive and capable of direct feeding to a utility power grid.

Definitions:

For the purpose of this guide, the following definitions are used:

- Alternating Current (ac): Electric current that reverses direction periodically, usually 60 cycles per second for residential and commercial applications.
- Alternating Current Photovoltaic (PV) Module: A complete environmentally protected unit consisting of solar cells, optics, inverter and other components exclusive of tracker, designed to generate AC power when exposed to sunlight.
- Array: A mechanically integrated assembly of modules or panels with a support structure and foundation, tracker and other components as required forming an AC or DC power-producing unit.
- Authority Having Jurisdiction (AHJ): An organization, office or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation or a procedure.

Direct Current (DC): Electric current that flows in one direction.

Hybrid System: A system comprised of multiple power sources. These power sources may include photovoltaic, wind, micro-hydro generators, engine-driven generators and others, but do not include electrical production and distribution network systems. Energy storage systems, such as batteries, do not constitute a power source for the purpose of this definition.

Interactive System: A solar photovoltaic system that operates in parallel with and may deliver power to an electrical production and distribution network. For the purpose of this definition, an energy storage subsystem of a solar photovoltaic system, such as a battery, is not another electrical production source.

Inverter: Equipment that is used to change voltage level or waveform, or both, of electrical energy. Commonly, an inverter [also known as a power conditioning unit (PCU) or power conversion system (PCS)] is a device that changes DC input to an AC output. Inverters may also function as battery chargers that use alternating current from another source and convert it into direct current for charging batteries.

Listed: Equipment, materials or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material or service meets appropriate designated standards or has been tested and found suitable for a specific purpose.

Module or PV Module: A complete environmentally protected unit consisting of solar cells, optics and other components, exclusive of a tracker, designed to generate direct-current (DC) power when exposed to sunlight.

Panel: A collection of modules mechanically fastened together, wired and designed to generate electricity when exposed to sunlight.

Solar Cell: The basic photovoltaic device that generates electricity when exposed to sunlight.

Solar Photovoltaic (PV) System: The total components and subsystem that, in combination, convert solar energy into electric energy suitable for connection to utilization load.

Stand-Alone System: A solar photovoltaic system that supplies electrical power independently of an electrical production and distribution network.

Storage Battery: A battery comprised of one or more re-chargeable cells of the lead-acid, nickel-cadmium or other electro-mechanical types.

Utility Interactive Output Circuit: The conductors between the utility interactive inverter and the service equipment or another electric power production source, such as a utility, for electrical production and distribution network.

Utility Interactive Over-current Device: The final breaker/fuse that is installed where the utility interactive conductors connect to the service equipment.

Part II. Applicant's Responsibility

Applicants are responsible for submitting a completed permit application form with two sets of plans containing electrical, structural and site information to demonstrate compliance with the appropriate codes and ordinances. A building permit will be required for all installations. Electrical and plumbing sub-permits can be utilized, as needed.

Part III. Prerequisites

Due to the diversity and flexibility of Solar PV electrical and physical installation schemes, minimum electrical design information must be provided in order to confirm compliance with the National Electrical Code (NEC). For systems exceeding 600 volts ac or dc, or for systems exceeding 800 amperes of production capability, the electrical design must be prepared by an electrical engineer licensed in the state of Nevada.

The mounting scheme(s) and attachment methods of the panel array must be provided in order to assure a safe installation that meets the minimum load requirements of the International Building Code (IBC), the standards referenced in the IBC, and local ordinances. The structural design aspects may need to be prepared by a registered design professional licensed in the State of Nevada. This determination will be established during the plan review. See part VII for more information.

Solar PV projects are submitted under an electrical permit application. Zoning approval is required prior to review by Plans Examination. Due to the extent of the electrical review, Solar PV plans are generally not reviewed over the counter by Plans Examination and therefore must be logged in with the exception of single-family residential installations of 5 KW or less.

Part IV. Applicable Codes

Currently adopted:

- Clark County Building Administrative Code
- National Electrical Code
- Southern Nevada Amendments to the National Electrical Code
- International Building Code
- Southern Nevada Amendments to the International Building Code
- Title 30, Unified Development Code

Part V. Submittal Package

The submittal package shall consist of an appropriately filled out electrical sub-permit application with an assigned permit application number, two sets of completed and signed plans by the homeowner or applicable design professional for commercial projects, a completed contact information sheet, and a signed contract identifying the negotiated contract cost.

Part VI. Plan Contents

The following list constitutes the minimum plans submittal requirements for Solar PV systems:

- Provide a side plan showing where the PV panels will be installed.
- Provide a site plan/floor plan showing the locations of the inverter(s), source-circuit combiner boxes, net inverter disconnect and existing service.
- Clearly identify the orientation of the PV modules/panels (flush mount on sloped or flat roof, tilt mount on flat roof shade parking structure, tracker etc). This must be shown on a scale drawing.

Proximity to property lines and any elevation increases to a building roof must be shown.

- Identify whether property elevation is above 6000 feet for snow load considerations.
- Provide structural details showing how the PV modules/panels are mounted/attached to the ground or support structure.
- Show all conductor sizes from the PV panels to the tie-in point (line-side tap or panel bus).
- Specify conductor type (MC, THHW etc).
- Specify conductor temperature rating (75/90 degrees C).
- Specify conduit size and type where applicable (PVC, EMT, RGS)
- Show all over-current protection devices and sizes and where they occur.
- Identify the size and location (end of bus or center of bus) of the main breaker and back-fed breaker for utility interactive systems.
- Identify the bus rating of the service/distribution board/panel where the back-fed breaker is installed.
- Show bonding for PV panels and Inverter system (cannot daisy chain panels, must be T connections).
- Provide a single-line diagram of the Solar PV system to be installed (items 6 through 13 can be shown here).
- Provide calculations identifying voltages and worst case current loads on strings and feeders.
- Provide the manufacturer cut sheet for the PV module(s) to include evidence of listing.
- Provide the manufacturer cut sheet on the Inverter system with evidence of listing to include UL 1741 for utility interactive systems.

For Systems with storage batteries, the following additional information is required.

- The location and configuration of battery storage must be shown on a site plan/floor plan.
- Show how hydrogen gas ventilation is achieved for lead acid and similar type batteries.
- Battery installation must comply with Article 480 and with part VIII of Article 690 of the NEC.

Part VII. Other Information

Prior to submitting plans to the building department, refer to the utility company requirements for net metering system installation at the following link:

<http://www.nvenergy.com/business/newconstruction/newconstructionS/meters.cfm>

If you live in a community with a homeowner association that restricts alterations or additions to your property, be sure to obtain prior approval for a solar PV installation. The building department is not responsible for an association declining a solar PV system installation for any reason.

Fire Department code development issues for rooftop photovoltaic cells: Rooftop solar PV systems are becoming more prevalent in the Las Vegas area. As such, the Fire Department requires additional measures for their safety in responding to emergencies. They are as follows:

- A minimum clear space of 3 ft. shall be provided around all sides of rooftop photovoltaic cell installations.

EXCEPTION: For sloped roofs, clearance is not required between the edge of the eave and the array, provided that clearance is provided vertically up the slope of the roof on both sides of the array running continuous from the eave to the ridge, and clearance is also between the ridge and the array.

- A disconnect shall be provided immediately downstream of photovoltaic arrays' main feed to the inverter. Such disconnect shall be located on the rooftop and labeled to indicate the disconnect controls the main feed from the photovoltaic array to the main electrical box.

Please contact the Clark County Fire Department at (702) 455-7311 for applicability and/or changes to the above code development issues.

The registered design professional should take the information listed below into consideration when preparing the construction documents.

1. If the solar panel system increases the gravity load to the roof framing system by more than 5%, then the roof framing will need to be reevaluated for the additional loads (2009 IBC 3403.3). The new solar panels would be considered additional dead load. The registered design professional cannot swap the existing roof live load in the area covered by the panels for the dead load of the new solar panels.
2. Solar panels, support systems and attachments must be designed for the wind and seismic loads prescribed in the IBC. Typically, wind will govern the design but the panel connections must still be detailed for seismic resistance. The seismic design requirements are specified in ASCE 7-05 Chapter 13. The panels would be considered an electrical component. Before determining the seismic detailing requirements you need to know the Seismic Design Category (SDC) and the component importance factor.
 - Electrical components in SDC B are exempt from the provisions of Chapter 13.
 - Electrical components in SDC C with an $I_p=1$ are exempt from the provisions of Chapter 13.
 - Electrical components in SFC D with an $I_p=1$ and weighing 400 lbs or less and less than 4 feet in height are exempt from the provisions of Chapter 13.
3. The solar panels must have test data or design information to demonstrate integrity at design wind pressures.
4. Solar photovoltaic systems are subject to the special inspection provisions outlined in IBC Chapter 17. This includes the inspection of fabricators per 1704.2.

Clark County Building Department Locations & Services

MAIN OFFICE 4701 W. Russell Road Las Vegas, NV 89118 (702)455-3000	On-Site Plan Submittals All "Walk-Through" Plan Review / Permitting Functions Residential Tract Submittal / Permitting All Sub-Trade (Electrical, Plumbing & Mechanical) Permitting Building Inspection Scheduling Functions Records	Temporary Certificate of Occupancy Submittals Building Inspections Building Inspector Inquiries Amusement / Transportation Systems Operation Certificates Approved Fabricators Quality Assurance Agency Listing
LAUGHLIN OFFICE Regional Government Center 101 Civic Way Laughlin, NV 89029 (702)298-2436	Building Inspection Services	
OVERTON OFFICE 320 North Moapa Valley Blvd. Overton, NV 89040 (702)397-8089	Building Inspection Services	

Automated Phone System (702) 455-3000

- Option 1:** For all Inspection services or to report a building code violation.
Option 2: For information regarding on-site permits or new plan submittals.
Option 3: For the Building Plans Examination division or QAA information.
Option 4: For the Zoning Plans Examination division.
Option 5: For information or copies regarding land development, construction documents, plans or permits.
Option 6: To speak with Management staff.
Option #: For hours of operation, Office location and website information.

Other Clark County Departments/Divisions/Districts

Air Quality & Environmental Management	500 S. Grand Central Parkway, Las Vegas NV	(702) 455-5942
Public Works, Development Review Services	500 S. Grand Central Parkway, Las Vegas NV	(702) 455-6000
Comprehensive Planning	500 S. Grand Central Parkway, Las Vegas NV	(702) 455-4314
Fire Department	575 E. Flamingo Road, Las Vegas NV	(702) 455-7316
Las Vegas Valley Water District	1001 S. Valley View Boulevard, Las Vegas NV	(702) 870-2011
Southern Nevada Health District	625 Shadow Lane, Las Vegas NV	(702) 759-1000
Water Reclamation District	5857 E. Flamingo Road, Las Vegas NV	(702) 668-8888

State of Nevada

Division of Water Resources	400 Shadow Lane, Suite 201, Las Vegas NV	(702) 486-2770
Nevada State Contractors Board	2310 Corporate Circle, Suite 200, Henderson NV	(702) 486-1100

Utilities

Nevada Power	6226 W. Sahara Avenue, Las Vegas NV	(702) 402-5555
Southwest Gas	5241 Spring Mountain Road, Las Vegas NV	(877) 860-6020

www.clarkcountynv.gov/depts/development_services